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PROCEEDINGS.

Nine hundredth Meeting.

May 11, 1898. — Annual Meeting.

Vice-President Lowell in the chair.

In the absence of the Secretaries, John Trowbridge acted as Corresponding Secretary and Edwin H. Hall as Recording Secretary.

The Report of the Council was read.*

The Treasurer presented his annual report, of which the following is an abstract: —

General Fund.

Receipts.

Balance, May 1, 1897			$1,961.73
Assessments	$1,005.00		
Sale of publications	238.86	$1,241.86	
Income from investments		4,663.82	
Return of bank tax		40.00	
Legacy of Hon. John Lowell		3,000.00	
Donations		105.00	9,050.68
			$11,012.41

Expenditures.

General expenses	$2,026.00	
Publishing expenses	1,365.31	
Library expenses	1,139.15	$4,530.46
Investments		3,000.00
Balance, April 30, 1898		3,481.95
		$11,012.41

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* See Proceedings, Vol. XXXIII, p. 517.

RUMFORD FUND.

Receipts.

Balance, May 1, 1897		$3,133.66
Income	$2,366.25	
Return of bank tax	94.04	2,460.29
		$5,593.95

Expenditures.

Books and binding	$94.10	
Publishing	59.91	
Investigations	1,651.50	
Rent	10.00	$1,815.51
Investment		2,000.00
Balance, April 30, 1898		1,774.84
		$5,593.95

WARREN FUND.

Receipts.

Balance, May 1, 1897	$870.95
Income	855.00
	$1,725.95

Expenditures.

Investigations	$800.00
Balance, April 30, 1898	925.95
	$1,725.95

BUILDING FUND.

Receipts.

Balance, May 1, 1897	$773.78
Income	494.36
	$1,268.14
Balance, April 30, 1898	$1,268.14

The Librarian presented his annual report, of which the following is an abstract: —

2,751 books and pamphlets have been added to the library during the past year, of which 2,089 were obtained by gift and exchange, 513 purchased with the appropriation from the income of the General Fund, at a cost of $336.25, and 149 with the appropriation from the income of the Rumford Fund, at a cost of $23.92. 224 volumes were bound at an expense of $331.95, of which $32.75 was charged to the Rumford Fund. 185 volumes were borrowed from the Library by 33 persons, of whom 24 were Fellows of the Academy.

The following reports were also presented: —

Report of the Rumford Committee.

At the last Annual Meeting of the Academy the sum of $1,000 was placed at the disposal of the Rumford Committee for use in aid of investigations to which the Rumford Fund may properly be applied.

During the past year appropriations from this have been made as follows: —

(1) To Professor George E. Hale, Director of the Yerkes Observatory, $400, to meet in part the expense of the construction of a large spectro-heliograph.

(2) To Professor A. G. Webster, of Clark University, $250, for the construction of an electrically governed revolving mirror.

(3) To the same, $100, for an investigation upon the Zeeman effect.

(4) To Professor A. A. Michelson, of the University of Chicago, $250, to meet the cost of constructing a new form of interference spectrometer. To this appropriation an additional amount of $250, from the Rumford Fund, was added by vote of the Academy at its March meeting, on recommendation of the Committee.

(5) In addition to these, at the request of the Committee, the Academy at its January meeting voted to grant the sum of $400, from the Rumford Fund, to Professor W. C. Sabine, of Harvard University, for a research on ultra-violet radiations.

In response to a request sent to these and other recent grantees, asking for information as to the progress of the researches to which aid had been rendered, replies have been received as follows: —

Professor Hale writes: "I have at last succeeded in obtaining two Voigtländer portrait lenses of 6¼ in. aperture, which are to serve as the principal optical parts of the spectro-heliograph. These lenses, which now cost $600 each, were purchased for $185 each. The balance of the $400 appropriation is to be used in paying an instrument maker who will be employed in constructing the spectro-heliograph.

I have engaged for this purpose the most skilful instrument maker we ever had at the Observatory, and feel certain that he will build a most satisfactory instrument. The large 60° prisms (4 in. on an edge and 6½ in. high) have already been obtained, and as I am now engaged in making the drawings of the spectro-heliograph, we may reasonably hope that it will be ready before many months have elapsed."

Professor Hale adds, "I feel very grateful to the Rumford Committee for rendering possible the construction of an instrument which should certainly give valuable results when employed with the 40-inch telescope."

Professor Webster writes as follows regarding (2). The "appropriation of $250 for a revolving mirror has not been drawn upon. I have made various experiments to determine the power required, and the friction of bearings of various sorts, and expect to have the instrument constructed during the summer vacation."

Regarding (3) he writes: "The intention was to apply Michelson's method of the interferometer, using however an instrument to measure the visibility, instead of depending, as has hitherto been done, upon eye estimates. On considering the relative advantages of the bolometer, the radiomicrometer, and the radiometer, the last named instrument appeared to be the most convenient, and was therefore chosen. Most of the time has been spent in constructing and experimenting with the radiometer, with the result that, if the instrument was made sensitive enough to measure the quantities involved, its zero was constantly changing, and the instrument was altogether too slow for the purpose. The glass plates of the interferometer also absorbed such a large fraction of the radiation that the method would have been impracticable, without fluorite plates, which would have entailed a large expense. We have therefore reluctantly been obliged to give up work on the Zeeman effect, and the money will be returned."

Professor Michelson writes that his paper read at the April meeting of the Academy may be considered as a report of progress of his investigation, the "echelon spectroscope" there shown being the first made instrument of its kind. The amount of the appropriation still unexpended, about $300, will be applied to the construction of a larger instrument of the same character.

Professor Sabine states that the camera made for his investigation by Clark and Sons has barely been completed within the past few days, under which circumstances it has not yet been possible to begin experimental work.

Statements have also been received from persons to whom recent appropriations have been granted, but prior to May, 1897, as follows: —

Professor B. O. Peirce, of Harvard University, was granted an appropriation of $200 in 1892, and a further appropriation of $250 in 1895, for researches upon the thermal conductivity of rocks and other poor conductors. A preliminary paper has been published in the American Journal of Science, with the consent of the Rumford Committee, and also a table of roots of a Bessel Equation, in the Bulletin of the American Mathematical Society. The cost of the investigation, which has proved to be a very laborious one, has greatly exceeded the amount of the grant. It is expected to publish the final results in the near future.*

Professor F. A. Laws, of the Massachusetts Institute of Technology, was granted $300 in 1894, to aid in an investigation of the thermal conductivity of metals by a new method proposed by him. The research was delayed for a time, but is now in active progress, and it is probable that numerical results will be secured very soon. The unexpended balance of the appropriation will be applied to the determination of the conductivities of other metals.

Professor E. L. Nichols, of the Cornell University, received in 1894 a grant of " a sum not exceeding $500 " (on the authorization of the chairman) in aid of a study of the emissive power of carbon at different temperatures. Professor Nichols reports that absence from the country for a year, and various unforeseen difficulties have delayed progress, although much time has been spent on preliminary work. The expenses of the research are only in part met by the appropriation from the Rumford Fund, of which about $200 has been expended.

Professor Edwin H. Hall, of Harvard University, received a grant of $250 in 1895, in aid of an investigation on the thermal conductivity of metals. The research thus aided was embodied in part in a paper presented to the Academy on January 8, 1896, on the "Thermal Conductivity of Mild Steel." A second paper relating to the thermal conductivity of cast iron is likely to be ready for publication during the coming summer.† There is at present an unexpended balance of $120.

Professor A. G. Webster received a grant of $250 in 1895, for a research on the velocity of electrical waves. Regarding this research Professor Webster says: " A part of the money has been expended partially to defray the expense of the construction of a machine for measuring the interval between the rupture of two electrical contacts, which is the main apparatus used. I have undertaken to attain an accuracy up to one ten-millionth of a second, and the experiments already made encourage me to believe that I shall succeed. On account of the mechanical difficulties involved by the high speeds used, the apparatus has had to be changed a great many times, and the work has been very intermittent. The apparatus is therefore not yet completed, but I hope it will be by summer, when I shall be able to complete the experiments. The sum of about $100 remains unexpended, but will be required before the experiments are completed."

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* See Proceedings, Vol. XXXIV. No. 1.

† Ibid., No. 11.

Professor Henry Crew, of the Northwestern University, was granted $400 in 1896, to aid a research upon the arc-spectra of metals. A paper embodying in part the results of this research, entitled "Sources of Luminosity in the Electric Arc," was recently presented to the Academy, and is now in press.* An unexpended balance of $29.84 will be employed in the prosecution of further research in the same general direction.

Mr. R. O. King, then of Harvard University, received a grant of $100 in 1896, for aid in a research upon the "Thomson Effect in Metals." A paper embodying the results of the research thus aided, and entitled "The Thomson Effect in Copper," was presented to the Academy by Professor E. H. Hall at its meeting in April, 1898. A balance of about $10 remains unexpended.

It was voted by the Committee, at a meeting held March 9, 1898, that the Academy at its Annual Meeting be asked to appropriate the sum of $1,000, as in previous years, to be expended under the direction of the Committee in furthering investigations in Light and Heat.

The Committee has also considered at length the question of an award of the Rumford Medal. The claims of various investigators and inventors have been considered with great care, and more than one among them appeared to be deserving of such recognition. After prolonged consideration, the Rumford Commitee has voted at two separate sessions, in accordance with long established custom, to recommend to the Academy an award of the medal to Professor James E. Keeler, now Director of the Lick Observatory, for his application of the spectroscope to astronomical problems, and especially for his investigations of the proper motions of the nebulæ, and the physical constitution of the rings of the planet Saturn, by the use of that instrument.

CHARLES R. CROSS, *Chairman.*

May 11, 1898.

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* See Proceedings, Vol. XXXIII. No. 18.

REPORT OF THE C. M. WARREN COMMITTEE.

In behalf of the C. M. Warren Committee, I have to report that at the last Annual Meeting of the Academy the sum of $600 from the income of the Warren Fund was granted to Professor C. F. Mabery, of Cleveland, in furtherance of his researches on the composition of petroleums. A letter from Professor Mabery, dated March 23, 1898, gives a clear idea of the present condition of his work.

With regard to other grants from the Warren Fund, now outstanding, viz., those to Professor Phillips of Allegheny City for the investigation of natural gas, and to Professor Hofman of Boston for work on the fusibility of slags, there are good reasons for believing that satisfactory progress is being made by both these chemists.

F. H. STORER, *Chairman.*

May 11, 1898.

REPORT OF THE COMMITTEE OF PUBLICATION.

The publications of the past year consist of four numbers of Vol. XXXII., and the first seventeen numbers of Vol. XXXIII., of the Proceedings, aggregating 464 pages and 9 plates.

Only one of these numbers was printed at the charge of the Rumford Fund. The others have cost $1,365.31. The appropriation for publications made by the Academy from its General Fund in May last was $2,100, leaving an unexpended balance of $734.69, to which must be added $236.86 from the sales of the year, or a total balance of $971.55.

The Committee hopes that at least the greater part of this may be added to the ordinary annual appropriation of $1,800, as some unusual expenditures are looked for.

SAMUEL H. SCUDDER, *Chairman.*

May 11, 1898.

On the recommendation of the Committee of Finance it was

Voted, To make the following appropriations from the income of the General Fund for the ensuing year: —

For general expenses	$1,500.00
For the Library	1,600.00
For publishing	2,500.00

Voted, That the assessment for the ensuing year be five dollars.

On the recommendation of the Rumford Committee it was

Voted, That one thousand dollars ($1,000) from the income of the Rumford Fund be placed at the disposal of the Rumford Committee to be expended in aid of investigations on Light and Heat, payments to be made on the order of the Chairman of the Committee.

Voted, To award the Rumford Premium to James Edward Keeler, for his application of the spectroscope to astronomical problems.

On the recommendation of the C. M. Warren Committee it was

Voted, That the sum of six hundred dollars ($600.00) from the income of the Warren Fund be granted to Professor Charles F. Mabery, of Cleveland, Ohio, for the continuation of his researches on petroleums.

Voted, That the sum of thirty dollars ($30.00) from the income of the Warren Fund be granted to Professor H. O. Hofman of Boston, for the continuation of his research on the composition and fusibility of slags.

The annual election resulted in the choice of the following officers and committees: —

Alexander Agassiz, *President.*
John Trowbridge, *Vice-President for Class I.*
Alpheus Hyatt, *Vice-President for Class II.*
Augustus Lowell, *Vice-President for Class III.*
Samuel H. Scudder, *Corresponding Secretary.*
William Watson, *Recording Secretary.*
Eliot C. Clarke, *Treasurer.*
Henry W. Haynes, *Librarian.*

Councillors.

Edwin H. Hall, Henry Taber, Theodore W. Richards,	of Class I.
Benjamin L. Robinson, William T. Councilman, John E. Wolff,	of Class II.

John E. Hudson,
Barrett Wendell, } of Class III.
Edward Robinson,

Member of the Committee of Finance.

Augustus Lowell.

Rumford Committee.

Erasmus D. Leavitt, Amos E. Dolbear,
Edward C. Pickering, Arthur G. Webster,
Charles R. Cross, Theodore W. Richards,
Thomas C. Mendenhall.

C. M. Warren Committee.

Francis H. Storer, Henry B. Hill,
Charles L. Jackson, Leonard P. Kinnicutt,
Samuel Cabot, Arthur M. Comey,
Robert H. Richards.

The Chair appointed the following standing committees: —

Committee of Publication.

Samuel H. Scudder, Seth C. Chandler,
Crawford H. Toy.

Committee on the Library.

Amos E. Dolbear, G. Stanley Hall,
Samuel Henshaw.

Auditing Committee.

Henry G. Denny, John C. Ropes.

The following gentlemen were elected members of the Academy: —

Robert DeCourcy Ward, of Boston, as Resident Fellow in Class II., Section 1 (Geology, Mineralogy, and Physics of the Globe).

Francis Cabot Lowell, of Boston, as Resident Fellow in Class III., Section 1 (Philosophy and Jurisprudence).

George Lyman Kittredge, of Cambridge, as Resident Fellow in Class III., Section 4 (Literature and the Fine Arts).

George Howard Darwin, of Cambridge, as Foreign Honorary Member in Class I., Section 1 (Mathematics and Astronomy), in place of the late James Joseph Sylvester.

Nine hundred and first Meeting.

October 12, 1898. — Stated Meeting.

Vice-President Hyatt in the chair.

The Chair announced the death of Samuel Eliot, Resident Fellow in Class III., Section 3 ; James Hall, Associate Fellow in Class II., Section 1; Thomas McIntyre Cooley, Associate Fellow in Class III., Section 1; William Ewart Gladstone, Foreign Honorary Member in Class III., Section 3.

The Corresponding Secretary read letters from G. L. Kittredge, Francis C. Lowell, F. Brunetière, G. H. Darwin, and Alb. Heim, acknowledging their election into the Academy; from Alexander Agassiz, announcing his resignation as Director and Curator of the Museum of Comparative Zoölogy at Cambridge; from the Royal Academy of Sciences of Turin, announcing the death of Carlo Giacomini and of Giuseppe Gebelli; from the Polish Association for the Promotion of Medical and Natural Knowledge, in reference to the exclusion of Poles from its meeting at Posen; from the Physico-economical Society at Königsberg, stating the subjects and conditions of award of certain prizes; from August Dauber, of Bochum, calling attention to Professor Edward Buchner's experiments made in Berlin; and from W. Potter, of Victoria, soliciting subscriptions to the Baron von Müller's grave monument fund.

A communication from the Department of State, announcing the date of the next meeting of the International Congress of Orientalists, and inviting the Academy to send delegates, was referred to a committee, consisting of the President, the Vice-President of Class III., and the Corresponding Secretary.

James Ford Rhodes, of Boston, was elected a Resident Fellow in Class III., Section 3 (Political Economy and History).

On the motion of A. G. Webster, it was

Voted, That the date of reception be placed at the head of papers received for publication, instead of or in addition to the date of presentation, so that papers may be printed, if necessary, without waiting for presentation at a meeting.

Arthur G. Webster exhibited and described Maxwell's Dynamic Top.

The following papers were read by title: —

On Certain Derivatives of Symmetrical Trichlorbenzol. By C. Loring Jackson and F. H. Gazzolo.

On the Action of Sodic Ethylate on Tribromdinitrobenzol. By C. Loring Jackson and Waldemar Koch.

Trinitrophenylmalonic Ester, Second Paper. By C. Loring Jackson and J. I. Phinney.

A Revision of the Atomic Weight of Nickel, Second Paper. The Determination of the Nickel in Nickelous Bromide. By Theodore Wm. Richards and Allerton S. Cushman.

A Revision of the Atomic Weight of Cobalt, Second Paper. The Determination of the Cobalt in Cobaltous Bromide. By Theodore Wm. Richards and Gregory P. Baxter.

The Contact-potential between Metals and Fused Salts, and the Dissociation of Fused Salts. By Clarence McC. Gordon. Presented by Theodore Wm. Richards.

Some Electrochemical and Thermochemical Relations of Zinc and Cadmium Amalgams. By Theodore Wm. Richards and Gilbert N. Lewis.

On the Thermal Conductivity of Cast Iron. By Edwin H. Hall and C. H. Ayres.

On Fluctuations in the Composition of Natural Gas. By Francis C. Phillips. Presented by the C. M. Warren Committee.

Shoreline Topography. By F. P. Gulliver. Presented by W. M. Davis.

Nine hundred and Second Meeting.

NOVEMBER 23, 1898. — SPECIAL MEETING.

The Academy met at the house of the President, Cambridge.

The PRESIDENT in the chair.

The Chair announced the death of David Ames Wells, Associate Fellow in Class III., Section 3; and of Pierre Cécile Puvis de Chavannes, Foreign Honorary Member in Class III., Section 4.

A letter was read from the Corresponding Secretary of the Colonial Society of Massachusetts, thanking the Academy for past courtesies, and requesting the use of its hall for the five stated meetings of the Society during the ensuing year.

On the motion of the Recording Secretary, it was

Voted, To grant the request of the Colonial Society.

The following papers were presented by title: —

Japanese Collembola. By J. W. Folsom. Presented by S. H. Scudder.

The Use of the Transition Temperatures of Complex Systems as Fixed Points in Thermometry. By Theodore Wm. Richards and J. B. Churchill.

The following papers were read: —

On the Relationship of the Oceanic Currents and the Pelagic Fauna. By Alexander Agassiz.

Notes. (*a*) On Allen's Application of the Indicator Diagram to Rowing. (*b*) Progress in the Use of a Ring Pendulum for Gravity Determinations. By Thomas C. Mendenhall.

Nine Hundred and third Meeting.

DECEMBER 14, 1898.

The Academy met at the Jefferson Physical Laboratory, Cambridge.

VICE-PRESIDENT TROWBRIDGE in the chair.

John Trowbridge spoke on High Tension Electricity and exhibited a number of photographs which illustrated the disruptive effects of electrical discharges.

The Academy then visited the Laboratory rooms and witnessed several experiments, among which were the passage of electrical discharges over water in preference to a path through it, and other experiments illustrating the good conducting power of air under powerful electro-motive force. Electrical discharges six feet in length in ordinary air were shown, and it was made evident that in order to submit atmospheric air to a pressure of three million volts the apparatus would have to be raised to a considerable height above the earth, and be removed from all surrounding objects. The various investigations now being pursued in the Laboratory were explained, and the apparatus shown. Among these investigations were three which are being carried on under the aid of the Rumford Committee: one on Heat Conductivity, by B. O. Peirce and R. W. Willson; one also on Heat Conductivity, by Edwin H. Hall, who explained his apparatus; and one on the measurement of very short waves of light. In this latter subject Theodore Lyman and E. H. Colpitts have succeeded in obtaining the shortest wave lengths of metals hitherto measured.

Harold Edwards explained his investigation on measurements with an improved air thermometer. H. H. Brown exhibited his apparatus for the measurement of dielectrics, and a new method of measuring electric waves in air was described and exhibited.

John E. Wolff presented the following papers by title: —

A Comparative Study of Etch-figures: the Amphiboles and Pyroxenes. By R. A. Daly.

On the Optical Characters of the Vertical Zone of Amphiboles and Pyroxenes: and on a new Method of determining the Extinction-Angles of these Minerals by Means of Cleavage-Pieces. By R. A. Daly.

Nine hundred and fourth Meeting.

JANUARY 11, 1899. — STATED MEETING.

VICE-PRESIDENT HYATT in the chair.

The Corresponding Secretary read letters from the International Geographical Congress, announcing its seventh meeting at Berlin on the 28th of September, 1899; from the Royal Academy of Sciences, Letters, and Arts in Modena, announcing the death of its President, Pietro Riccardi; and from James Ford Rhodes, accepting Fellowship in the Academy.

The Chair announced the death of John Cummings, of Woburn, Resident Fellow in Class III., Section 3.

Letters of resignation were received from Mellen Chamberlain, Charles James Sprague, and Warren Upham, Resident Fellows.

The following gentlemen were elected members of the Academy: —

Arthur Amos Noyes, of Boston, as Resident Fellow in Class I., Section 3 (Chemistry).

Henry Paul Talbot, of Newton, as Resident Fellow in Class I., Section 3.

Oliver Fairfield Wadsworth, of Boston, as Resident Fellow in Class II., Section 4 (Medicine and Surgery).

Charles Doolittle Walcott, of Washington, as Associate Fellow in Class II., Section 1 (Geology, Mineralogy, and Physics of the Globe), in place of the late James Hall.

Oliver Heaviside, of Newton Abbots, as Foreign Honorary Member in Class I., Section 2 (Physics).

John Fiske gave a talk on Eccentric Literature.

Remarks on this communication were made by E. H. Hall and T. C. Mendenhall.

Nine hundred and fifth Meeting.

February 8, 1899.

Vice-President Hyatt in the chair.

John E. Wolff presented, by title, a paper by R. A. Daly, On a New Variety of Hornblende.

William E. Story gave a talk on some mathematical curiosities, exhibiting and explaining some things commonly called puzzles or tricks.

Nine hundred and sixth Meeting.

MARCH 8, 1899 — STATED MEETING.

VICE-PRESIDENT HYATT in the chair.

The Corresponding Secretary read a letter from the Imperial Mineralogical Society of St. Petersburg, announcing the death of Paul Ieremeiew.

The Chair appointed the following Councillors to serve as Nominating Committee: —

EDWIN H. HALL, of Class I.
BENJAMIN L. ROBINSON, of Class II.
JOHN E. HUDSON, of Class III.

The following papers were read: —

On Hardystonite, a new Calcium Zinc Silicate from Franklin Furnace, New Jersey. By John E. Wolff.

Investigations on Periodicity in the Weather. By H. Helm Clayton.

Remarks on these papers were made by Messrs. Story, Hall, and Webster.

The following papers were presented by title: —

Contributious from the Gray Herbarium of Harvard University, New Series. — No. XV. I. *Eleocharis ovata* and its American Allies. II. *Scirpus Eriophorum* and some related Forms. By M. L. Fernald. Presented by B. L. Robinson.

Contributions from the Gray Herbarium of Harvard University. — New Series, No. XVI. I. Revision of the Genera *Montanoa*, *Perymenium*, and *Zaluzania.* By B. L. Robinson and J. M. Greenman. II. Synopsis of the Genus *Verbesina*, with an analytical Key to the Species. By B. L. Robinson aud J. M. Greenman. III. Some new Species, extended Ranges, and newly noted Identities among the Mexican Phanerogams. By J. M. Greenman.

The Orthopteran Genus Schistocerca. By Samuel H. Scudder.

Nine hundred and seventh Meeting.

APRIL 12, 1899. — ADJOURNED STATED MEETING.

The Academy met at the Mineralogical Laboratory, University Museum, Cambridge.

The PRESIDENT in the chair.

The Chair announced the death of Othniel Charles Marsh, of New Haven, Associate Fellow in Class II., Section 3.

A letter was read from the Massachusetts Historical Society, thanking the Academy for the use of its hall for the meetings of the Society during the last two years.

The following papers were read: —

The Structure and Origin of Agates, illustrated by Specimens from the Bigelow Collection, and by the Projection on the Screen, by the Arc Light, of Sections in Polarized Light. By John E. Wolff.

A new Manganese Pyroxene from Franklin Furnace. By John E. Wolff.

Petrographical Notes on some Rocks from the Fiji Islands. By A. S. Eakle. Presented by J. E. Wolff.